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PLANNING FOR THE LOCATION OF MUNICIPAL GARAGES

A THESIS

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SUMMARY

This study was undertaken to produce a guide for public works officials and planners in planning for the location of municipal garages in urban areas. Three aspects of municipal garages are discussed: (1) operation; (2) need; and (3) location.

The operation of municipal garages is discussed with respect to: (1) management arrangements practiced by local governments for maintaining and controlling vehicles and equipment; (2) organizational components of equipment maintenance operations, including central garages, district garages and mobile repair units; (3) physical facilities required to maintain, service and store equipment; and (4) records necessary for operating and maintaining vehicles and equipment. This discussion forms a basis for determining the need for municipal garages.

The need for municipal garages primarily includes: (1) estimating equipment requirements based upon work programs and capital improvement programs; (2) evaluating municipal ownership and maintenance of equipment by an examination of plans, policies and problems regarding costs and management; and (3) analyzing the equipment maintenance system through an analysis of all municipal equipment maintenance operations, and a study of the location of equipment use in urban areas. This information is a prerequisite to selecting appropriate locations for municipal garage sites to meet existing and future needs.

The two primary considerations in locating municipal garages are:

(1) location within the urban area in respect to equipment use, access to major thoroughfares and influences on adjacent development; and (2) site characteristics, including size, land costs, topography and soils and utilities. In taking these considerations into account certain planning studies should be undertaken. These include a municipal garage study, a site survey, a land use study and a transportation study.

The major conclusions of this study are: (1) a municipal garage located as near as possible to the center of equipment use and having direct access to major transportation routes can provide more prompt and efficient municipal services, in addition to reducing operating costs; (2) garage sites should be selected that have sufficient area for expansion to meet future equipment requirements for a minimum of 10 years; (3) adverse features of maintenance and storage operations affecting surrounding development can be minimized through proper land use planning by specific planning studies; and (4) reservation of specific sites on an Official Map is one method of encouraging the proper location of municipal garages as they relate to the future land use plan.

CHAPTER I

INTRODUCTION

A municipal garage is a place for the service, maintenance and storage of a variety of vehicles, equipment, materials and supplies which are needed to provide the community facilities and services offered by municipal governments. For the purposes of this study, the term municipal garage also includes "city yards," "maintenance yards," "maintenance center" and "service center."

Dependable and efficient maintenance and repair of mechanized equipment are probably the most important elements in a sound public works operation.[1] The average city now spends about 30 per cent of its annual operating budget for the acquisition and maintenance of equipment.[2] Also, the growing variety, number, and bulk of equipment used in providing the necessary city services and utilities has caused municipal governments to become increasingly aware of the need for better garages in a properly planned location.

Municipal garages have become a problem in many urban areas. Equipment and maintenance facilities are: (1) located in obsolete downtown or central locations; (2) located on sites that are too small to to permit expansion; (3) located in outmoded buildings, many of which were never designed for such use; or (4) scattered throughout the city by departmental function. In addition, improperly located municipal garages have caused increased traffic congestion because of the growing number and larger size of motorized equipment for public works operations.

Municipal garages often generate noise, dust, unsightliness and heavy truck and equipment traffic which makes them incompatible with some types of development, especially residential.

Little attention is given by local governments in their equipment budgets to the physical facilities needed to provide necessary maintenance, repair and service.[3] Most municipalities have not provided for municipal garages in planning the city's development. As a result, municipal garages are located with little attention given to their relationship to the community.

Objective

The objective of this thesis is to propose methods which can be used by city planners and public works officials to promote a more compatible relationship between municipal garage locations and orderly urban development. This objective was accomplished by studying various management arrangements and organizational components of equipment maintenance operations practiced by municipal governments; by reviewing the types of garage facilities, and by giving proper consideration to the aspects of the community affected by the location and operation of municipal garages.

Because of the differences in size, administration, management, geographical area and location of cities, a proper municipal garage site can be selected only after careful study of the individual municipality. However, by applying the information presented in this thesis, planners and public works officials should be able to decide on a site and facility which meet the existing and future needs of their communities.

Method

Information for this study was obtained from a review of existing literature, examination of several municipal garages in the metropolitan area of Atlanta, Georgia, and interviews or correspondence with persons or agencies involved in or having knowledge of municipal garage location and operation in urban areas.

CHAPTER II

THE OPERATION OF MUNICIPAL GARAGES

The purpose of this chapter is to provide a general understanding of the various types of municipal garage operations. The primary aspects of the municipal garages set forth in this study include: (1) management arrangements; (2) organizational components of equipment maintenance; (3) physical facilities; and (4) records. No attempt is made to present a detailed, technical description of the maintenance operation.

Management Arrangements

Local governments traditionally have used a departmental or a central agency management arrangement for maintaining and controlling vehicles and equipment.

Departmental

In some cities, each department is responsible for the service and repair of its own equipment. Each department head assumes responsibility for procurement, custody, care, assignment and record-keeping for the equipment in his department. The primary disadvantage of this management arrangement is a duplication of specialized and seasonal equipment, tools, mechanics and maintenance facilities. Also, this arrangement makes it difficult to equalize the use of trucks and equipment between departments during slack work schedules, and complicates, rather than simplifies the purchase and storage of repair parts and supplies.

Departmental control is desirable for some types of specialized equipment. Fire equipment is usually maintained by fire department personnel. Equipment used in utility operations is frequently the responsibility of separate boards. Certain departments such as docks and harbors, police and parks provide their own maintenance services because of the specialized nature of their equipment or operations.

In general, departmental maintenance and control is appropriate only for a small community with limited equipment or for certain departments with highly specialized equipment.

Central Agency

Many municipalities place responsibility for maintenance, service and storage operations in a central agency. This central agency is responsible for operating a municipal garage to provide the various operating departments of municipal government efficient, economical and convenient maintenance and service of all or most equipment.

The City of Baltimore, Maryland, in a report on a proposed central automotive repair shop, stated that centralizing control over all equipment in one agency would produce the following advantages:

1. Sound technical advice on equipment purchase;
2. Improved budgeting for equipment needs;
3. Elimination of duplicate and excess equipment;
4. Complete record-keeping and cost analysis; and
5. More economical operation through reduction in idle equipment time.[4]

The central agency may be either the department of public works or a staff or service agency. Generally, the following factors influence this decision:

1. Does the city have equipment maintenance facilities that are

under the direct supervision of an operating department other than a central garage?

2. What agency is basically responsible for purchasing new equipment and replacements?

3. What agency "owns" the equipment and how are purchases financed?

4. What agency is responsible for carrying out a preventive maintenance program?[5]

Department of Public Works. In a 1956 survey conducted by the International City Manager's Association, 71 per cent of the reporting cities located the garage in the public works department.[6] Often the garage is a separate division of the department, but sometimes it is within a division. For example, the street division of the public works department operates the garage facilities of St. Louis Park, Minnesota, and Lake Park, Illinois.[7] Responsibility for the municipal garage in Dallas, Texas is placed in the public works department as a division, but for all practical purposes it operates as an independent agency serving all departments.[8]

The principal justification for having the public works department operate the municipal garage is that the major part of the city's vehicular equipment is operated by the public works department and responsibility is assigned to the department that uses most of the heavy equipment. Also, the public works department generally employs personnel possessing the basic skills necessary to carry out maintenance and service operations.

When the public works department operates centralized maintenance

service, the most common practice in cities is for all other departments to retain the responsibility for procurement, custody and assignment of equipment.

Staff or Service Agency. Occasionally the responsibility of the municipal garage is assigned to a staff or service agency in the office of the mayor or manager, along with other central services such as purchasing, personnel and finance. Examples of this arrangement are found in Lubbock, Texas;[9] Long Beach, California;[10] and Park Ridge, Illinois.[11] Here it can maintain all or most municipal equipment of various city departments in a safe and serviceable condition as needed on an equal basis.

The International City Managers' Association recommends that a central garage should have basic control over all or most equipment when placed under a staff or service agency.[12] In addition to centralized maintenance services, this arrangement allows for the assigning of equipment on a part-time basis to certain departments.

The Cincinnati, Ohio, municipal garage is a good example of completely centralized maintenance and control of equipment operated as a staff or service agency. Central ownership and assignment have provided good service to operating departments. For example, used police department vehicles are reassigned to other departments with lower performance demands. The arrangement to equalize the use of vehicles has made it possible to eliminate extremely old equipment and to simplify the purchase and storage of repair parts and supplies.[13]

In the Cincinnati operation all vehicles are assigned to the using departments, with the provision that the superintendent of the

municipal garage may make transfers of vehicles from one department to another. Thus, it occurs that each department or division utilizes and dispatches its vehicles independently.

Cincinnati's centralized maintenance services operate under a municipal equipment committee appointed by the city manager to supervise the purchase and assignment of equipment. The committee is composed of the assistant to the city manager, the budget officer, the director of public works, the purchasing agent and the superintendent of the municipal garage. The operating departments submit requests for equipment with detailed specifications to the committee for their action.

Organizational Components of Equipment Maintenance

Cities generally use one or a combination of the following organizational components of municipal equipment maintenance operations: (1) central garages; (2) district garages; and (3) mobile repair units. All of these vary considerably according to the size and organizational structure of the city and the scope and nature of maintenance operations.

Central Garages

A central garage provides for centralized maintenance service varying from the simplest to the most complicated operation for all or most equipment. Frequently, central garages act as operational headquarters for various divisions of public works operations and other departments. This provides for close contact and coordination with centralized offices, yards, shops and warehousing.

Night shifts of mechanics and servicemen are occasionally used in conjunction with central garages for both emergency service and routine maintenance, particularly in large cities. Such arrangements permit routine service to be done off hours and result in a more even distribution of the work load. Greensboro, North Carolina, uses night shifts to avoid interrupting work schedules.[14] When work loads are not sufficient to justify the use of night shifts, cities can contract for night and holiday emergency service with private automotive or truck service shops.

Central garages are normally located on sites in or near the geographical center of the city. Houston, Texas;[15] Miami, Florida;[16] and Atlanta, Georgia, are but a few large cities with central locations near downtown. Atlanta, Georgia's central garage repairs and stores a large number of its street cleaning and refuse collection trucks during the day that operate in or near the downtown area at night.[17]

From an operational standpoint, a modern central garage has proved to be more efficient and economical than scattered garages requiring considerable duplication of equipment and facilities. However, centralized maintenance services performed by a centrally located municipal garage does not preclude the use of a desirable arrangement of district garages in large cities as a means of reducing travel time.

District Garages

District garages, under the control of a central garage, were found to exist primarily in large cities. Such facilities range from simple service stations to extensive installations.

For example, Omaha, Nebraska, has five district garages, one of

which serves as the central garage near the downtown area.[18] Figure 1 shows the five delineated "maintenance districts" of the city served by district garages.

In addition to a central garage near the geographical center of the city, the City of Cincinnati, Ohio, has nine district garages within a ten-mile radius of the central facility. Each district garage is staffed by one mechanic who does minor repairs and servicing of vehicles in the area. The mechanic also responds to calls for road service.[19]

Dallas, Texas, has four service centers, one in each quadrant of the city. In addition to garage and repair facilities, these centers house units for street maintenance, storm and sanitary sewers, police substations and certain water department equipment. A fifth garage, located near downtown, services all vehicles operating from the city hall and most police vehicles. All of the garages are self-contained units.[21]

Atlanta, Georgia, has a heavy-equipment division district garage located approximately 2-1/2 miles from its central garage near the downtown area because of: (1) a lack of need for heavy-equipment excluding street maintenance equipment, in a central location; (2) a demand for space at the central garage being greater for other maintenance operations requiring a central location; and (3) a need to minimize conflicts with vehicular traffic.[22]

District garages often offset their increased costs of maintenance and supply by savings in travel time of equipment and personnel. They can be used to relieve the work load of the central garage. Baltimore,

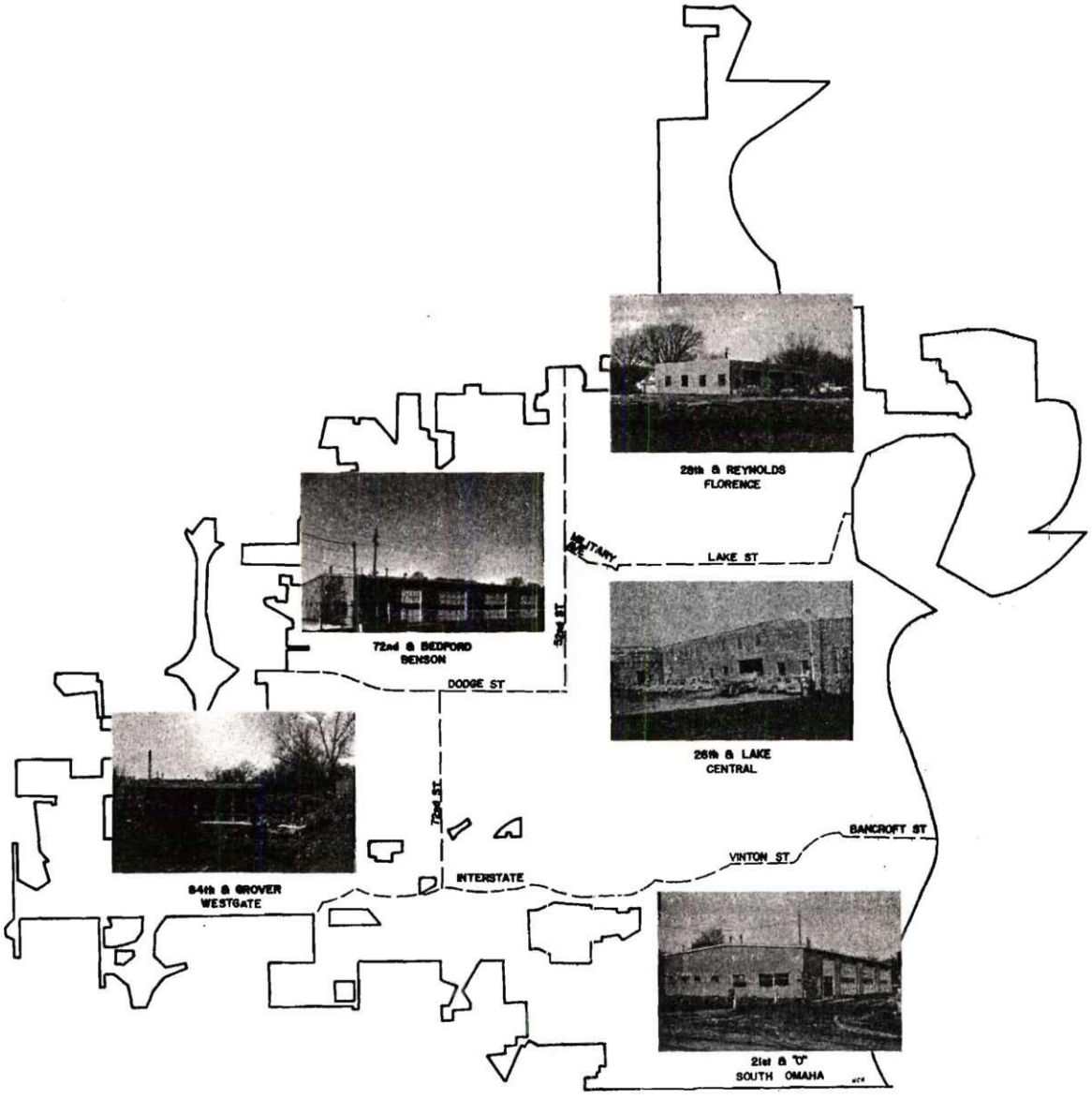

Figure 1. Maintenance District Garages. Omaha, Nebraska.[20]

Maryland,[23] and San Diego, California,[24] found that the establishment of district garages increased efficiency and economy of their maintenance operations. Prior to San Diego's establishing two new district garages, field crews consumed nearly one quarter of their time traveling between job sites and a central facility located near the downtown business district.[25] Nashville, Tennessee, built two new district service centers to service approximately 50 square miles of newly annexed territory and to lessen congestion of vehicles and equipment at their central garage. Vehicles assigned to the new district service centers saved between 20 and 25 minutes of travel time daily.[26] Also, vehicles remaining at the central garage gained approximately 10 minutes each because of less congestion. After adjustment for full-time personnel assigned to the new district service centers, savings of approximately $50,000 per year were estimated. Even small cities find that district garages with only fuel dispensing and lubricating facilities reduce maintenance service collection and distribution costs.

The author's sample survey of 186 selected cities throughout the country revealed that of the 67 respondents, the use of district garages becomes more prevalent as the size of the city increases. (See Table 1.)

Mobile Service Units

Some cities operate mobile service units equipped to do fairly extensive repair work in the field. Such units have proven valuable for the maintenance of construction-type equipment, such as bulldozers, shovels, graders and other heavy equipment. For example, in Saginaw, Michigan, a mobile unit is used to service all heavy equipment of the public works department on the job and to supply fuel to non-automotive

Table 1. Survey of Municipal Garages by Type by Population of Cities*

Population	Municipal Garages by Type by City Size							
	Total Reporting	Central		District		Other**	
0 - 50,000	21	21	100%	1	5%	7	33%
50,000 - 100,000	15	15	100%	6	40%	3	20%
100,000 - 250,000	19	19	100%	12	67%	6	32%
250,000 and Over	12	11	91%	9	75%	6	50%
Total	67						

*Based on author's survey (See Appendix A).

**Includes Utility and Fire Departments.

equipment of other departments and divisions during the daytime. At night, the mobile unit is used to service all trucks and other motorized equipment stationed in the central garage yard.[27]

Physical Facilities

The physical facilities required to maintain, service and store equipment usually depend upon a variety of considerations, such as the size of the operation, degree of centralization and climate. Generally, the four major elements that comprise the physical facilities of a municipal garage are: (1) administrative offices; (2) shops; (3) storage buildings; and (4) storage yards. The design of each of these elements will vary in terms of satisfying a city's particular needs.

Administrative Offices

Administrative offices of the municipal garage are generally found in a centralized maintenance facility. Space is provided for the garage superintendent, dispatcher-radio communication office, classrooms, combination lunch room and meeting room, and lockers and showers for field personnel. When a central garage serves as an operational headquarters for various divisions of public works operations and other departments, additional office space is required. For example, in Greensboro, North Carolina, administrative offices for the departments of public works, building and grounds, recreation, parks, traffic engineering and police patrol are located in the municipal garage.[28]

Shops

A variety of shops with special tools and equipment are needed in a municipal garage. The amount and nature of such facilities and equipment depend basically on the volume of activity and policy on the use of outside garages and shops. The three major types of shops generally found in a municipal garage are: (1) maintenance and repair; (2) service; and (3) special shops.

Maintenance and Repair Shops. A municipal central garage generally is equipped to do all or most all of the maintenance and repair operations that are performed by commercial garages. Items include adequate overhead hoisting equipment, hydraulic lifts, diesel and gasoline engine servicing and testing equipment, equipment for wheel balancing and alignment, brake servicing equipment, ignition and battery items, valve grinders, and other pieces normally used in a modern automotive shop. For efficient and economical repair of vehicles and equipment,

proper tools and equipment should be available in order to avoid makeshift maintenance and repair methods.

Service. Service shops in a municipal garage normally provide for routine lubrication and cleaning of vehicles and equipment. Items include overhead dispenser reels for lubrication, oil, water, air and hydraulic fluid in service bays. Air-powered tire wrenches and tire changing equipment is necessary. Also, facilities such as wash racks and steam or pressure cleaning equipment should be provided.

Special Shops. Large public works and utilities operations require a variety of special shops. These special shops normally consist of machine and welding, carpentry and cabinet-making, painting, radio and electronics, meter repair of all kinds and other miscellaneous shops. For example, Wauwatosa, Wisconsin, has a sweeper room in its service center for the storage and winding of mechanical sweeper brooms.[29] The service center of Greensboro, North Carolina, provides special shops for the repair, service and storage of radios, traffic signals, parking meters and street signs for its traffic engineering department.[30]

Storage Buildings

Equipment and materials storage is closely related to maintenance operations. Adequate provisions should be made for: (1) covered storage sheds for motorized vehicles and equipment when not in use; and (2) warehousing for necessary parts, supplies and miscellaneous tools. Many cities use these facilities for central storage of records, office supplies, janitorial supplies and building maintenance equipment.

The types of storage facilities needed depend on climate. In warm climates, equipment can be housed in covered sheds with open sides.

However, in northern latitudes during the winter, equipment will require overnight and weekend storage in heated buildings. Individual cities should analyze to what extent storage facilities should be heated, enclosed but unheated, roofed or open. "On the basis of a comprehensive study, a large U. S. corporation recently discontinued the practice of providing inside storage for equipment."[31] Depreciation of equipment and overall operating economies should be weighed against necessary capital expenditures and maintenance of storage facilities.

Storage Yards

Out-door storage yards for miscellaneous equipment and supplies, such as pipe, construction materials and fuel storage, are essential to effective public works operations. Water and sewer utility departments and street maintenance departments or divisions normally require more space for storage of equipment and supplies than any other departments. After four years of operation, Greensboro, North Carolina, expanded its storage yard to stock items whose use was common to all operating departments to take advantage of: (1) lower prices through volume purchases; and (2) the elimination of manpower to pick up or receive small purchases.[32]

The size of a storage yard usually depends on the amount of land available at the garage site, especially at central garages. However, central storage requirements can be reduced by using auxiliary yards. Some cities use rental or lease arrangements for the parking and overnight storage of automobiles and light trucks on private property such as commercial parking lots and garages.

Atlanta, Georgia, utilizes a "covered" site under an elevated

segment of interstate highway near the downtown area for the overnight storage of its street maintenance trucks and equipment. This site offers convenient access to Atlanta's expressway system for routine maintenance. Auxiliary yards should have good accessibility for scheduled maintenance, service and dispatching and should be protected against vandalism.

Records

The municipal garage is normally responsible for keeping records on the quantity and performance of all equipment with the finance department providing technical supervision. Continuous records should be maintained to provide data on the operations of each individual piece of equipment for the purposes of making the following determinations:

1. whether operating costs for a particular piece of equipment are high or low when compared with those of other equipment of the same type;

2. whether unit costs for a particular piece of equipment have increased substantially over previous periods;

3. whether particular pieces or kinds of equipment should be leased or purchased;

4. which makes and types of equipment are best suited for particular operations;

5. whether dispatching of equipment is conducted efficiently;

6. whether rental rates are in line with costs;

7. when preventive maintenance should be scheduled;

8. when it is desirable to dispose of a piece of equipment.[33]

Each city should develop a system of records to provide cost and operating data. Detail and method vary, but certain records are

necessary. These records are: (1) Individual Equipment Record; (2) Equipment History Record; (3) Repair Order Form; (4) Gas and Oil Ticket; and (5) Daily Equipment Summary Sheet. The Municipal Finance Officers' Association publication, "Accounting for Government-Owned Motor Equipment," sets forth in detail specific procedures for compiling these records.[34] In large equipment operations, most of these records are automated. Ottawa, Ontario, Canada,[35] and Richmond, Virginia,[36] have completely automated data processing record systems for their equipment.

Records on the operation of equipment can be recorded graphically by an automatic recording device known as "tachograph." This device gives graphic records showing time, mileage, speed and operation of various equipment for refuse collection, materials hauling and street cleaning. Information produced by this automatic recording device is analyzed at the end of each recording period: (1) to determine needed adjustments of routes and schedules; and (2) to correct any operational problems showing up.[37] Oakland, California, and Ottawa, Ontario, Canada, use this recording device to improve their street cleaning operations.[38]

CHAPTER III

DETERMINING THE NEED FOR MUNICIPAL GARAGES

The initial step in planning for a municipal garage involves a determination of the need. The need for municipal garages, as well as the primary purposes for which they are designed, their size and their location are dependent upon: (1) estimating equipment requirements; (2) evaluating municipal equipment ownership and maintenance; and (3) analyzing the equipment maintenance system.

Estimating Equipment Requirements

Estimating equipment requirements is extremely important in determining the need for a municipal garage. Unfortunately, it is quite difficult to set forth an accurate method for projecting equipment needs because of unpredictable changes in equipment and the different requirements of individual communities. The best sources for estimating future equipment requirements are: (1) sound work programs; and (2) a well developed capital improvements program.

Work Programs

Work programs are developed from past knowledge of the different departmental work loads and anticipated changes in the future work. Some activities are subject to definite measurement from data derived through accurate departmental record and reporting systems. For example, the street cleaning work load can be fairly accurately determined by the miles of streets to be cleaned, frequency of cleaning and the

method of cleaning. Other activities, such as snow removal and certain kinds of street maintenance, may require a different type of analysis. Statistical comparisons covering a period of years should be used to develop the work program and to establish trends in the amount of equipment needed by departmental activity. Each municipality should analyze the following factors that influence local work programs and operating costs:

1. the scope and quality of services provided;

2. the volume of work required to render the services;

3. methods, facilities, and organization for performing the work;

4. qualities and types of labor, material, equipment, and other costs elements required by the work volumes; and

5. price levels of the various cost elements.[39] The International City Managers' Association's publication, "Municipal Public Works Administration," sets forth standard methods to develop these work programs.[40]

Capital Improvements Program

Review of a community's capital improvements program aids in estimating long-range departmental equipment needs. This review is necessary when various projects of the capital improvements program are not scheduled to be done by contract to determine if the acquisition of additional equipment is justified. If a project requiring special equipment is of a continuing nature, purchase of the additional equipment should be considered and included in the capital improvements program. However, if the need for special equipment is only temporary,

leases or rental contracts should be used.

Evaluating Municipal Equipment Ownership and Maintenance

After estimating its equipment requirements a municipality should evaluate its plans, policies and problems of: (1) costs of operating and maintaining municipally-owned equipment; and (2) management of equipment maintenance facilities.

Costs

The costs of operating and maintaining municipally-owned vehicles and equipment should be analyzed prior to the development of plans for building a municipal garage. This analysis should be based on accurate records kept on all equipment as to their use, need, cost, performance and depreciation. These records could reveal possible methods other than government ownership to minimize operation and maintenance costs. These include: (1) employee ownership and travel allowances; (2) rental or leasing contracts with commercial firms or manufactures; and (3) guaranteed maintenance contracts with manufacturers or distributors. Also, rental arrangements of equipment by one governmental jurisdiction to another governmental jurisdiction should be considered.

The American Public Works Association sets forth guidelines in determining whether to use employees' cars, to lease or rent equipment, or to own them. (See Appendix C.) Any municipality can make a graphic representation, as shown in Figure 2, that illustrates readily the relative advantages and disadvantages of the several arrangements.

Some cities invite bids on specified equipment with a guaranteed

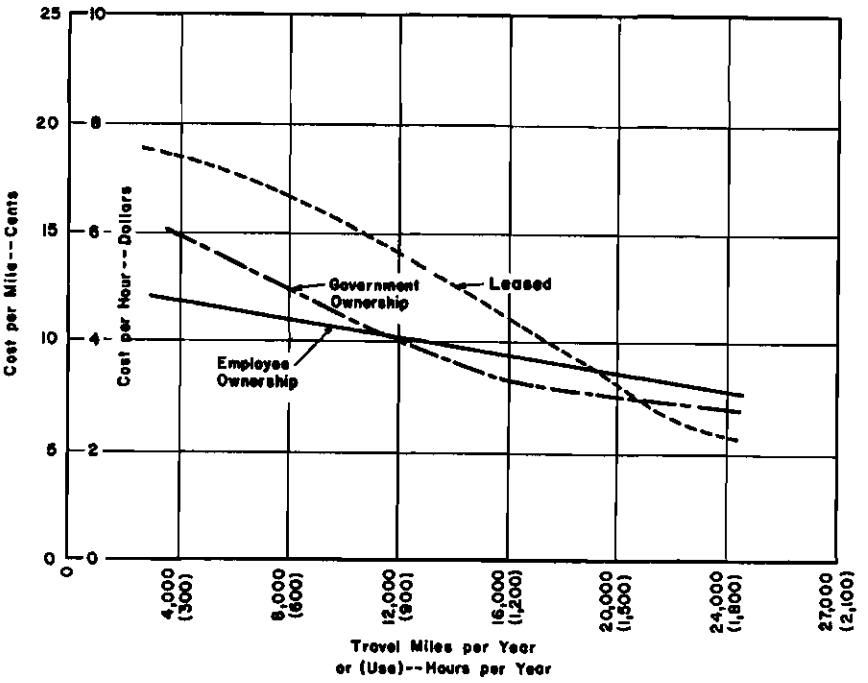

Figure 2. Equipment Operating Costs by Type of Ownership - Any Jurisdiction.[41]

maintenance program for its anticipated useful life. Although the municipality owns the equipment, the contractor supplies all parts and labor with a specified "down-time" and penalty clause. Usually the city is responsible for costs resulting from fire, theft and collision.

The City of Chicago recently purchased seventy-five new refuse collection trucks under a guaranteed maintenance contract, thus eliminating the need for maintenance facilities for these trucks.[42] The major reasons for entering into a guaranteed maintenance contract for these trucks were: (1) increasing fleet expansion to meet the demand for increasing volumes of refuse; (2) existing garage facilities

had certain physical limitations prohibiting further expansion of equipment maintenance and servicing; and (3) the price per month for guaranteed maintenance by the contractor was approximately 25 per cent lower than the City's estimated costs.[43] The results of the program to date "have been more than satisfactory."[44] Amarillo, Texas, uses the guaranteed maintenance contract on its heavy earthmoving equipment in the sanitation department as a means for: (1) meeting specifications with equipment dealers standing behind their product beyond the normal warranty period; and (2) relieving the city of the need to budget for maintenance during the first several years.[45]

Cities should investigate possible arrangements for the rental of equipment from or to other governmental jurisdictions. Although few cities and counties have equipment available for use by others, it may be both feasible and desirable for a state, county or city to buy a special high-cost item and recover part of the cost by renting it to other governmental jurisdictions. For example, Alameda County, California, in which the city of Oakland is located, has offered equipment to other jurisdictions at its internal rates of charges plus a surcharge.[46] Also, Oakland, and the Port of Oakland, a separate political entity, use equipment in common successfully.[47] Proper planning among neighboring jurisdictions for procurement of vehicles and equipment for rental and the scheduling of its use could significantly reduce operational costs and the need for maintenance facilities.

Management

Regardless of whether a departmental or a central agency management arrangement is used, local governments should analyze the management of

its equipment activities to see that the function of its municipal garage is properly carried out. This analysis is most important because of the numerous problems created in the management of equipment maintenance activities by vehicles and equipment becoming more specialized, complex and expensive. These major management problems are:

1. Shop Personnel - Garages are understaffed and the personnel employed do not have adequate skills to perform the work properly.

2. Equipment - More equipment is added each year and the new equipment is more complex and therefore more costly to maintain.

3. Service - The demand for faster service steadily increases along with the requesting department's dependence upon more highly mechanized equipment.

4. Equipment Abuse - The care of equipment in the field worsens each year because equipment operators are not well trained and many do not seem to care about the condition of their equipment.

5. Replacement Parts - It takes longer to obtain replacement parts from equipment manufacturers and more types of parts are required each year.[48]

Communities should first recognize and analyze its equipment maintenance problems through accurate equipment records, scheduling of maintenance work, and performance reports of shop personnel. If a lack of trained personnel and replacement parts is a major problem for the maintenance of certain types of heavy equipment with significant "down-time," communities may find it advisable to have lease, rent or guaranteed maintenance contracts. Such arrangements can significantly affect the need for maintenance and storage facilities, especially for

large cities.

Analyzing the Equipment Maintenance System

A municipality should analyze its entire maintenance system to determine the most efficient and economical methods of operation for the maintenance, service and storage of all municipal equipment. This study should include an analysis of: (1) existing garage facilities; (2) arrangement of garage facilities; and (3) location of equipment use.

Existing Garage Facilities

A garage facility inventory should analyze space requirements for: (1) administrative offices; (2) maintenance and repair shops; (3) special shops; and (4) vehicle and equipment storage. For example, an analysis of equipment storage requirements should answer the following questions:

1. What equipment is currently owned?
2. What additions are anticipated in the next 5, 10, or 20 years?
3. What are the policies relative to pooling, use of employee vehicles, and night home storage of vehicles, and what changes are contemplated?
4. What are the unit storage requirements for equipment currently and in the future?
5. What total space is required to store this equipment?
6. If present space is deficient,
   a. How much depreciation of equipment will result from this inadequacy?
   b. How much time does the inadequacy cost in making equipment available for use?
7. To what extent should heated, enclosed but unheated, roofed, or open storage be provided?
8. What space is available for expanded central and auxiliary facilities and what are the estimated costs of providing them?
9. To what extent should operations be decentralized; what savings in storage costs would result and what would the development of the new facilities cost?

10. What is the policy on parking of employee cars? If additional parking is to be provided, what will it cost and what charges should be made for it?
11. What overall operating economies will result from the proposed improvements?
12. What is the financial balance resulting from these analyses? Are the proposed capital expenditures justified?[49]

Such an analysis is necessary by each individual locality for administrative offices, maintenance and service shops and outdoor storage yards to estimate the need for new municipal garages.

Arrangement of Garage Facilities

In order to determine whether the equipment operations should be provided in the arrangement of one central garage, several district garages, or a combination of both types of facilities, a locality should develop a detailed fact-gathering program or system analysis. This program would consist of gathering all facts and details concerning the present maintenance operations, systematically recording the facts, analyzing the reasons for each step in the maintenance process, and finally redesigning the present system, if necessary, and installing a better maintenance arrangement. The fact-gathering program should include: (1) what is done; (2) why it is done; (3) who does it; (4) where each operation is performed; (5) when it is done; and (6) how the job is accomplished. This information can be obtained by interview of personnel and observation of the operation to determine the volume of work, location of the work and the equipment used. These facts are then recorded and analyzed. Each of the existing operations is studied to determine if it can be eliminated, rearranged, combined with another operation, simplified or performed at another location.

Utilizing this systematic approach, the City of Baltimore,

Maryland, determined it should replace thirty-eight independent garage functions with a central garage and five supporting district facilities.[50] Two of the district garages were new construction and the remaining three were alterations of existing facilities. In a detailed analysis of maintenance and service operations of all city departments, the study recommended a central automotive shop in a central location designed to serve as a centralized facility for the repair, maintenance and servicing of all types of motorized equipment for all city departments, except for the fire department. The district garages or substations were designed as a servicing facility to provide: (1) a point where some intermediate type of assistance could be given to keep vehicles in service and thus help reduce the operator's down-time on vehicles for minor items of service; and (2) the degree and type of service usually obtainable at any independent gasoline station.

The principal advantages found by the system analysis from the operation of substations or district garages were:

1. eliminate from the central garage the types of service requirements which characteristically are of short duration but yet tie up mechanics and work space in the central garage;

2. reduce the time required to reach and service disabled equipment;

3. economize on the storage of gasoline at substations through centralization;

4. permit overnight storage of certain types of equipment needed to service a particular section of the city;

5. alleviate the problem of storage of motor pool vehicles in

the central part of the city; and

6. enable more effective utilization of personnel, equipment and facilities.[51]

Equipment Use

An analysis of equipment use in respect to purpose, assignment, hours of operation and distance traveled provides the base for planning the location of a municipal garage. The following information should be compiled for all types of vehicles and equipment through accurate records and regular reporting of equipment operations by departmental function:

1. Number and type of equipment (cars, trucks, and special equipment).

2. Actual hours of work.

3. Idle time due to lack of work.

4. Downtime on account of mechanical breakdown.

5. Frequency of service and maintenance by method and location.

6. Normal travel time and routes to and from maintenance and storage facilities.

These data should be categorized by use and type of equipment having: (1) normal routes or schedules; and (2) varied assignments. The use of special equipment such as sweepers, refuse collection vehicles, and mowers have normal routes or schedules by districts or work areas. Maintenance, service and storage facilities for this equipment should be as close to their areas of use as possible. However, there are many types of equipment such as graders, trucks, tractors, loaders, cranes, rollers and bulldozers which are subject to varied assignments to

localities and types of work. Most of this equipment is used in outlying areas of new urban development. Also, equipment used on permanent assignments such as sanitary landfill sites and airports will normally be in fringe areas. Maintenance, service and storage of this equipment should be performed at district garages or serviced by mobile repair units, except for major repairs.

From an analysis of equipment use, public works officials with the assistance of the city planner should be able to determine what general localities are in need of facilities for maintenance, service and storage of municipal equipment. Public works officials should compare the existing and future equipment needs based upon their use within each district or service area to the capacity of the existing garage facilities that serve the same district or work area. This comparison will reveal what areas have or will have need for new garage facilities. For small cities under 50,000 population, what is considered districts or work areas may be their entire urban or incorporated area.

The planner can assist public works officials by furnishing information on the type of land use and density of development which will likely occur in a given area in the future. Consideration should also be given to future annexation of new developed or undeveloped areas. Knowledge of the location, type and density of development, combined with the public works information of approximately how much equipment is required based on standard work units of similar types of development within the community, the general location of necessary equipment maintenance, service and storage needs can be determined.

Once this has been done, the planner and public works officials should determine what specific sites would be most appropriate for municipal garages. The following chapter presents the factors that should be considered in determining the location of municipal garages.

CHAPTER IV

LOCATING MUNICIPAL GARAGES

This chapter presents the factors that should be considered in determining the location of municipal garages. Based on the author's sample survey of 186 selected cities, to which 67 responded, public works officials considered the following factors most important in the location of a city garage: (See Appendix A.)

		Per Cent of Respondents
First	Location Central to Equipment Use	84
Second	Adequate Size for Future Expansion	82
Third	Access to Major Streets	57
Fourth	Land Costs	27
Fifth	Influence on Adjacent Development	21
Sixth	Utilities	15

For the purposes of this study, the locational factors to be considered in planning for municipal garages are discussed under the headings "Location Within the Urban Area" and "Site Characteristics." Also, specific planning studies for locating municipal garages are outlined.

Location Within the Urban Area

The selection of a municipal garage location within an urban area involves finding a site that provides: (1) a location central to equipment use; (2) area for expansion; (3) access to major transportation

routes; and (4) minimum influence on adjacent development.

Central to Equipment Use

Municipal garages should be located as near as possible to the center of equipment use for the dispatching of vehicles and equipment. Travel time to and from a garage site is just as important as distance. The site should not be so located that vehicles and equipment travel congested principal streets or highways to reach it.

The travel time to and from a garage site is a major factor in determining the size of the area that can be served efficiently and economically by one garage facility. If the travel time is excessive, it may be possible to reduce maintenance service collection and distribution costs through the use of district garages in outlying areas. The author's sample survey revealed that public works officials and garage superintendents considered the average maximum travel time of men and equipment from a garage site to normal work areas and job sites to be 20 minutes. Table 2 indicates no significant difference in the average travel time of cities by population size, except for cities under 50,000 population.

The survey indicates that as the size of the city increases, the use of district garages becomes prevalent to a level of having a central garage supported by one or more district garages geographically located within approximately 20 minutes travel time to equipment use. (See Table 1.) Assuming a vehicle travels an average rate of speed of only 15 miles per hour, a municipal garage could adequately serve an area within a five mile radius of the site.

Table 2. Survey of Travel Time from Municipal Garage Sites by Population of Cities*

Population	Average Maximum Travel Time (Minutes)
0 - 50,000	17
50,000 - 100,000	21
100,000 - 250,000	21
250,000 and Over	22
Average Total	20

Area for Expansion

Cities should select a garage site that has adequate area for future expansion. Communities frequently find their present municipal garage sites prohibit future expansion and are forced to find another location. Municipalities should make every effort to select a site that will accommodate all presently planned facilities that may be needed in the foreseeable future. Surplus land should be planned in the development of the site for future expansion, and designed accordingly in the layout and construction of buildings. Generally a minimum 30 per cent expansion factor should be allowed in selecting a site. Greensboro, North Carolina, built its new service center in 1963 on a 17-acre site to take care of its needs for a ten year period with flexibility for expansion far beyond this time. However, in only a four-year period, parking areas and equipment storage yards have already been

expanded to meet increases in personnel working out of the center and the number of vehicles serviced at the site.[52]

Access to Major Transportation Routes

How well a potential municipal garage site is served by major transportation routes should be investigated and evaluated. Municipal garage sites should be located along or near major thoroughfares or collector streets which provide easy access to all parts of an urban area or its specific service area or district.

Conflicts between municipal equipment and other vehicular traffic should be avoided near municipal garages, especially in the downtown area. Adequate traffic and parking controls should exist adjacent to a garage site for ease of ingress and egress of heavy equipment and trucks. Also, traffic congestion and noise nuisance to residential and certain types of commercial properties can be minimized by routing traffic generated by the maintenance facility over secondary roads and collector streets, especially for district garages and auxiliary storage yards.

Access between municipal garage sites and interstate routes or other expressways should be carefully planned for a minimum of traffic disruption. Acceleration and deceleration lanes should be available to enable large trucks to maneuver into and out of the main traffic flow. The planner and the city engineer should consider the possibility of obtaining direct access from an expressway along a major thoroughfare to the municipal garage. The use of interstate routes or expressways for dispatching equipment to their work areas or job sites should be avoided during peak hour traffic.

Influences on Adjacent Development

The principal nuisances associated with a municipal garage should be minimized in their influence on adjacent development. These nuisances are dust, odors, unsightliness and increased vehicular traffic.

Proper site selection and design would greatly reduce these objectionable features. While it is desirable to locate the municipal garage in an industrial or commercial area, there may be times when the gatage site abuts residential property. When it is necessary to locate adjacent to residential or similar unrelated land uses, a buffer strip with adequate screening from the objectionable factors should be provided. Covina, California, recently built their new garage facilities on a 8.5 acre site in the middle of a residential area.[53] Large buffer strips with attractive landscaping were provided around the entire site to minimize conflicts with the surrounding neighborhood.

In order to avoid land use conflicts, many municipal governments have passed ordinances restricting the location of municipal garages. City zoning ordinances often restrict municipal garage operations to commercial or industrial zones or permit publicly-owned facilities in several zones as a special use only. Cities in which their zoning ordinances make no mention of municipal garages should locate them in zones that permit similar types of uses.

The author's sample survey of municipal garages revealed no consistent type of land use adjacent to central or district garage sites. (See Appendix B.)

Site Characteristics

The process of selecting a site for a municipal garage should include an evaluation of such potential site characteristics as: (1) size; (2) land costs; (3) utilities; and (4) topography and soils.

Size

The size of a municipal garage site is determined by present and future space requirements for the maintenance, service and storage of vehicles and equipment. These space requirements will vary according to the size and organizational structure of the city, the size and nature of the maintenance operation and whether the garage site is a central or district facility.

A review of current literature revealed that municipal garage sites range in size between 1 and 30 acres. This wide range of site sizes generally parallels the size of the city as to the number of pieces of equipment it owns. In large cities, central garages generally range in size between 2 and 10 acres when supported by district garages. District garage sites range in size between 1 and 20 acres adjunct to a central garage. The difference in size of central and district garage sites are due primarily to factors of costs and land availability, both of which favor district garages. Also, the use of auxiliary equipment storage yards affects the size of central garage sites.

The average site size of municipal garages found in those cities responding to the author's survey is shown in the table below: (See Appendix B.)

As shown in Table 3, difficulty arises in correlating the size of the city and the amount of equipment to the size of garage sites.

Table 3. Survey of Municipal Garage Site Sizes by Population of Cities*

Population	Average Site Size by Type Garage Facility in Acres		
	Central	District	Other
0 - 50,000	4.84	0.30	1.23
50,000 - 100,000	3.74	2.58	1.00
100,000 - 250,000	5.10	2.14	2.11
250,000 and Over	5.61	6.12	2.42

*Based on author's survey (see Appendix A.)

This is due to the following factors: (1) the use of motor pools; (2) policies relative to allowing employees to drive vehicles home at night; (3) rental and leasing arrangements that include storage provisions; (4) policies on parking of employee cars; (5) use of auxiliary yards; and (6) climatic conditions affecting equipment storage.

Land Costs

In most cities, the comparatively high cost of land is often a major factor in determining the location of a municipal garage. Municipalities confronted with selecting new locations for maintenance operations to minimize cost and increase efficiency find the use of city-owned land most advantageous. As one public official explained;

> The benefits of utilizing presently owned city land for constructing new facilities are readily apparent. The savings of the cost of land acquisition alone will usually cause an appreciable reduction in the overall project costs. Also, when additional land is procured by a public agency, it is removed from the tax rolls thereby reducing the city's tax base. Many a planned municipal facility improvement has received a death blow as the result of adverse public reaction to the increasing public ownership of real estate.[54]

However, the purchase price of the land to be used for a central or district garage should not control its location. Utilizing a new site that is city-owned in order to economize may prove to be more expensive in terms of excessive time loss in dispatching equipment than the older facility. Unless municipally-owned property meets the site characteristics of good accessibility, central to equipment use, and with sufficient area for expansion, it should not be considered. The economy of initial investment on site costs must be measured in terms of the long-range needs of equipment operations.

In order to save on land costs, many cities have developed garage facilities on suitable municipally-owned sites which were used formally as golf courses, incinerator sites, sanitary land fill areas and sewage treatment plant sites. Greensboro, North carolina, located its maintenance center on a 17-acre tract which at one time formed part of a municipally-owned golf course.[55] San Diego, California, located one of its district garages on a sanitary land fill site.[56] Also, Newburgh, New York, located its municipal garage on a site previously used for the city's existing gasoline pumps and underground storage tanks.[58]

Utilities

Adequate storm drainage should be provided to handle the run-off from the large amount of hard-surfaced area that will be on the site. The availability of water, sewer and electricity is a prime consideration in selecting a garage site. Special provisions should be made to prevent oil and other drippings from flowing into sewers.

Topography and Soils

The site for a municipal garage should be relatively level with

no abrupt changes in topography. Steep grades impede the maneuverability of large trucks and other heavy equipment. However, a good location can often justify correcting poor topographical conditions.

Topographical features should be checked to determine the cost of development. Rough approximations of the grading necessary for building sites, outdoor storage areas, and employee and vehicular parking areas should be made. The site's drainage problems due to large paved areas for vehicular maneuvering and parking. Grades of paved areas near buildings where maintenance and service of equipment is performed should not exceed 1 per cent.

Test borings of the soil should be made in order to determine its load-bearing strength. The quality of the soil should be adequate to support the foundations for the structures. Also, the quality of the soil will be important in determining the type of surfacing and sub-base material needed for large parking areas for vehicles and equipment.

Planning Studies

Suitable garage sites should be considered as part of a municipality's general development plan. The following studies can help determine appropriate locations for such facilities.

Garage Facilities Study

Each municipality should conduct a garage facilities study of its equipment maintenance, service and storage operations to determine the most appropriate size of a site to meet future equipment requirements This study should be based on the factors discussed in Chapter III,

"Determining the Demand for Municipal Garages." A detailed analysis of space requirements by departmental function should be made for: (1) administrative offices; (2) maintenance and service shops; (3) indoor parts and equipment storage; and (4) outdoor storage yards for equipment, materials and supplies, and employee parking. This study should provide sufficient detail preparatory to architectural studies for the construction of municipal garages.

Appendix B contains an illustrative example of the space requirements that were identified as part of the planned expansion of a central garage for St. Louis Park, Minnesota. The city has a present estimated population of 50,000 persons with a future saturation of approximately 65,000 persons.[59] A listing of the city's equipment by departmental activity is presented to illustrate equipment space requirements.

Site Survey

After areas have been identified which will need additional maintenance, service and storage facilities as discussed in Chapter III, "Analyzing the Maintenance System," a site survey should be conducted to identify sites within those areas which are suitable and potentially available for municipal garages. As part of the survey each site should be evaluated in terms of its location within the community and its specific site characteristics.

The planner and public works officials should investigate as part of the site survey the possibility of locating future municipal garage sites in conjunction with the planned development of other community facilities such as water and sewage treatment plants, future

re-use of sanitary landfill sites, incinerator plants, and other public facilities which are or will be abandoned and relocated. Also, sites within proposed urban renewal projects should be considered. The adverse influences of a municipal garage in conjunction with other community facilities should be evaluated before such a site is selected.

After the survey is completed the city should acquire the best site in accordance with future growth patterns of the community. The new site should be sufficient in size to accommodate future equipment requirements for a minimum of 10 years. A larger tract will permit future equipment needs to be met without the trouble often associated with new site selection due to the lack of area for expansion.

If a locality is not immediately in a financial position to acquire specific sites for future municipal garages, reserving such sites until they are needed or acquired should be accomplished through the use of the Official Map and subdivision regulations. Such designated sites would have the advantage of notifying private developers that a garage would be on the site selected and development could be planned accordingly through the use of subdivision regulations. Reserved sites should be in relation to commercial and industrial areas as part of the community's future land use and thoroughfare plan.

Land Use Study

Essential to the planning for the location of municipal garages is a detailed land use survey and analysis of the areas surrounding possible garage sites. The planner should define and delineate areas subject to adverse influences created by maintenance, service and

storage operations such as noise, dust, vibration, traffic congestion and unsightliness, as well as areas bordering roads which will carry heavy truck traffic.

The size of the area to be studied in the vicinity of each potential site will vary according to the type and density of development, topography and natural features. For example, an area heavily wooded with rolling topography that will screen the garage facility from sight and dampen noises will require less attention than level open terrain. However, the exact use of every parcel of land within a minimum radius of 600 feet or three blocks of a possible garage site should be determined and mapped. In addition, the condition of structures in the area should be evaluated and blighted areas defined.

Municipal garages should not be allowed to cause or accelerate the decline of surrounding development. Maintenance, service and storage facilities should be located in areas of similar type uses or in areas in transition from old and deteriorating residential development to commercial and industrial uses. Also, consideration should be given to future land use in the area and whether the area is highly developable.

Transportation Study

The planner and public works officials should coordinate the location of municipal garage sites with the community's major thoroughfare plan by a transportation study of the use patterns of all municipal equipment. In order to select among various potential garage sites the one most strategically located, a map of the city should be prepared showing the location and distribution of vehicles and equipment. This

map should show on an average weekly, monthly and seasonal basis by districts or work areas how and where equipment is used from all maintenance and storage facilities. The method for preparing this map would be similar to the preparation of an origin and destination traffic survey. Also, time and distance traveled maps to districts and work areas should be prepared for each potential site. The average maximum travel time of vehicles should not exceed between 20 and 25 minutes. This information should be correlated with existing and future street design capacities and traffic volumes of major streets serving access to and from potential garage sites.

Methods of analysis classed under "mathematical programming" have been developed for refuse collection route planning and disposal site locations which can be applied to selecting municipal garage sites.[60] Linear programming through the use of mathematical models can yield information on the location of a single garage site to minimize the total travel time from specific work points or districts. Los Angeles County, California, utilized such an approach in determining the location of refuse transfer stations.[61]

Considerable numbers of trucks and heavy equipment use the streets in the area of a municipal garage. Existing streets in the vicinity of potential garage sites should be inventoried in terms of width, grade, condition and bearing strength. All streets must be adequate for the gross weight of heavy equipment and designed for their average frequency of use.

Standards for street widths, turning radii, and grade include:

1. Major street rights-of-way widths between 60 and 120 feet with pavement widths between 40 and 80 feet.

2. Secondary street rights-of-way widths between 40 and 80 feet width with pavement widths between 30 and 60 feet.

4. Minimum turning radius of 25 feet.

5. Grades should be kept below 6 per cent if possible. A maximum acceptable grade is 10 per cent.

Conclusion

A municipal garage is an important and necessary land use for the maintenance, service and storage of vehicles, equipment, materials and supplies which are needed to provide the facilities and services offered by municipal governments. Municipal garages should be located on a site with direct access to major streets and as near as possible to the center of equipment use. The result is more prompt, efficient services to the citizen with the added benefit of reducing operating costs of local governments. The savings on site costs by locating garages on municipally-owned property must be measured, however, against possible losses resulting from inefficiencies in future equipment operations and poor relationship of municipal garages to existing and future service areas.

Garage sites should be planned with sufficient area for expansion to meet future equipment maintenance and storage requirements for a minimum 10-year period. Also, additional space should be allowed for outdoor storage yards and parking areas for employees working out of the municipal garage. Generally, a minimum 30 per cent expansion factor

should be allowed in planning an equipment maintenance facility.

Planners and public works officials should realize that municipal garages have certain features that may adversely affect surrounding development. Municipal garages should not be allowed to cause or accelerate the decline of residential, commercial, or other areas. The adverse features of municipal equipment maintenance operations can be offset by proper site selection and controls through specific planning studies.

In order to meet the growing needs of a rapidly expanding community, public works officials and planners should work together to furnish services to the public as efficiently and economically as possible through properly located municipal garages. The primary objective of making municipal maintenance, service and storage operations convenient to the location of equipment use, must not be accomplished at the expense of present and future liveability of the total community.

APPENDICES

APPENDIX A

RESEARCH INFORMATION PUBLIC WORKS EQUIPMENT MAINTENANCE AND SERVICE OPERATIONS

As part of the research conducted for this study, 186 public works officials of various size cities were selected at random from the membership roster of the American Public Works Association's 1967 Yearbook. The following questions were addressed each public works director or garage superintendent of an individual city:

1. How many maintenance and service garages does your city have? (Indicate by type if applicable)
   ___Central
   ___District or Sub Garages
   ___Other (Water, Util. Dept.)

2. What is the size of each garage site? (Acres)

	Central	District	Other
	___ ___	___ ___	___ ___
	___ ___	___ ___	___ ___
	___ ___	___ ___	___ ___

3. Approximately what percent of your garage sites are devoted to the following:

	Central	District	Other
Maintenance - Service Shops	___ ___	___ ___	___ ___
Equipment Storage Buildings	___ ___	___ ___	___ ___
Outdoor Storage Yards (Includes Equipment and Employee Parking area)	___ ___	___ ___	___ ___

TOTAL

4. What is the predominant type of development adjacent to your garage sites? (Check appropriate box)

	Central	District	Other
Residential	___ ___	___ ___	___ ___
Commercial	___ ___	___ ___	___ ___
Industrial	___ ___	___ ___	___ ___
Public	___ ___	___ ___	___ ___

5. How many pieces of equipment are serviced, repaired and stored at your garages? (Approximate)

___Central
___District or Sub Garages
___Other
___TOTAL

6. What do you consider the maximum travel time of men and equipment from a garage site to normal work areas and job sites?

_____ (Minutes)

6. Check below what you consider are the most important factors in the location of a city garage?

___Access to Major Streets
___Location Central to Equipment Use
___Adequate Size for Future Expansion
___Influence on Adjacent Development
___Utilities
___Land Costs
___Others (Explain)_____
_____

APPENDIX B

SITE CHARACTERISTICS OF MUNICIPAL GARAGES

This list of cities, arranged alphabetically by states according to population size, was compiled from the author's sample survey of 186 selected cities on site characteristics of municipal garages, to which 67 responded.

Cities of Population Size 0 - 50,000

City and State	(Number) and Acreage of Garage Sites by Type Facility			Existing Land Use Adjoining Garage Sites By Type Facility**		
	Central	District	Other*	Central	District	Other
Anchorage, Alaska	(1) 8.0	-	(3) 5.0 1.0 1.0	C	-	I R C
Corona, Calif.	(1) 2.0	-	-	P	-	-
Lakeland, Fla.	(1) 5.0	-	-	R	-	-
Melbourne, Fla.	(1) 6.0	-	-	I	-	-
Tallahassee, Fla.	(1) 2.5	-	-	P	-	-
Titusville, Fla.	(1) 2.6	-	-	R	-	-
Winterhaven, Fla.	(1) 1.5	-	-	R	-	-

Cartersville, Ga.	(1) 1.0	-	-	I	-	-
Valdosta, Ga.	(1) 1.9	-	-	R,C	-	-
Park Ridge, Ill.	(1) 2.0	-	-	R	-	-
Ames, Iowa	(1) 5.5	-	(3) 2.0 .5 .5	I	-	I R C
Iowa City, Iowa	(1) 15.0	-	(1) 1.0	C	-	C
Battle Creek, Mich.	(1) 3.0	-	(1) 2.0	I	-	I
E. Grand Rapids Mich.	(1) 10.0	-	-	P	-	-
South St. Paul, Minn.	(1) 3.0	-	-	C	-	-
St. Louis Park, Minn.	(1) 1.7	-	(1) NR	I	-	I
Jamestown, N. Y.	(1) 1.0	-	(1) 0.2	I	-	C
Anderson, S. C.	(1) 4.0	-	-	R	-	-
Oak Ridge, Tenn.	(1) 5.0	-	-	R	-	-
Appleton, Wis.	(1) 18.0	-	(3) 0.5 0.5 0.5	I	-	NR NR NR
Middleton, Wis.	(1) 3.0	(2) 0.3 0.3	-	I	I P	-

Cities of Population Size 50,000 - 100,000

City and State	(Number) and Acreage of Garage Sites by Type Facility			Existing Land Use Adjoining Garage Sites By Type Facility**		
	Central	District	Other*	Central	District	Other*
Riverside, Cal.	(1) 1.0	(1) 0.25	-	P	I	-
Santa Barbara, Cal.	(1) 0.25	(3) 0.14	-	P	C	-
Ft. Lauderdale, Fla.	(1) 10.0	(2) 3.0 3.0	-	R,C	I I	-
Pensacola, Fla.	(1) 10.0	(1) 12.0	-	R,C	R,C,P	-
Evanston, Ill.	(1) 2.5	-	(1) 1.0	P	-	P
Cedar Rapids Iowa	(1) 2.0	-	(1) 1.0	C,I	-	NR
New Rochelle, N. Y.	(1) 5.0	-	-	I	-	-
Durham, N. C.	(1) 0.9	(2) NR	-	C,I,P	NR	-
High Point, N. C.	(1) 2.5	-	-	R,I	-	-
Springfield, Ohio	(1) 5.0	-	-	R	-	-
Lancaster, Pa.	(1) 2.0	-	(1) 1.0	R,I	-	P
Columbia, S. C.	(1) 4.0	-	-	C	-	-
Waco, Tex.	(1) 3.0	-	-	R	-	-

Hampton, Va.	(1) 5.0	(1) 2.0	-	C	P	-
Roanoke, Va.	(1) 3.0	-	-	I	-	-

Cities of Population Size 100,000 - 250,000

City and State	(Number) and Acreage of Garage Sites by Type Facility			Existing Land Use Adjoining Garage Sites by Type Facility**		
	Central	District	Other*	Central	District	Other*
Little Rock, Ark.	(1) 1.0	(2) 1.0 1.0	(2) 1.0 1.0	P	C C	I I
Anaheim, Cal.	(1) 2.3	(1) 4.9	-	R,C	I	-
Fresno, Cal.	(1)10.2	(1) 1.4	(1) 3.9	C,I	C	R,C
Orlando, Fla.	(1)10.0	(1) 1.0	(1) 5.0	R,C	R,C	C
Savannah, Ga.	(1)10.0	(1) 1.0	-	I	P	-
Peoria, Ill.	(1) 1.5	-	(1) 0.8	I	-	R
Des Moines, Iowa	(1) 8.0	-	-	C	-	-
Kansas City, Kan.	(1) 2.5	(1) 3.5	-	R,I	R	-
Flint, Mich.	(1) 1.0	-	(1) NR	R,C,I	-	NR
Lansing, Mich.	(1) 3.0	(1)10.0	-	C	I	-
Lincoln, Neb.	(2) 3.0 2.0	(2) 4.0 3.0	-	C C	R C	-

Syracuse, N.Y.	(1) 1.0	(3) 2.0 1.0 1.0	-	C	I I I	-
Charlotte, N. C.	(1) 5.0	-	NR	C	-	NR
Winston Salem, N. C.	(1) 3.0	-	NR	C	-	NR
Amarillo, Tex.	(1)24.0	-	-	R,I	-	-
Austin, Tex.	-	(5) 1.0 1.0 0.5 0.5 0.5	-	-	C C C C C	-
Beaumont, Tex.	(1) 4.0	(1) 4.0	(1)1.0	R	R	C
Wichita Falls, Tex.	(1) 1.0	-	NR	R,C	-	NR
Richmond, Va.	(1) 4.0	(1) 0.5	-	NR	NR	-

Cities of Population Size 250,000 and Over

City and State	(Number) and Acreage of Garage Sites by Type Facility			Existing Land Use Adjoining Garage Sites by Type Facilities**		
	Central	District	Other*	Central	District	Other*
Phoenix, Ariz.	(1) 5.0	(3) 18.0 20.0 14.0	-	C	I I I	-
Oakland, Cal.	(1) 6.0	-	-	C	-	-
Miami, Fla.	(1) 1.5	(2) 14.0 7.3	(1) 2.0	C	R,C P	I

Detroit, Mich.	(1) 5.0	(6) 2.0 2.0 2.0 2.0 2.0 2.0	-	I	R R C C I I	-
Omaha, Neb.	(1) 4.0	(4) 4.1 3.4 2.0 5.0	-	R,C	R C P R,C	-
Akron, Ohio	-	7 Division NR		-	R,C,I	NR
Cleveland, Ohio	(1)20.0	(9) NR	-	I	NR	-
Columbus,	(1) 5.0	-	(8) 1.0 to 3.0	C	-	I,P
Dayton, Ohio	(1) 1.1	(2) 0.5 1.0	(1) 0.1	I	I I	R
Dallas,	(1) 9.5	(4) 5.5 5.5 5.5 5.5	-	R	C C P P	-
El Paso,	(1) 3.0	(3) 2.0 2.0 3.0	(4) 5.0 3.0 0.5 0.5	R	R I C	R C I P
Fort Worth, Tex.	(1) 1.0	(2) 2.0 2.0	(1) 1.0	C,I	R C	I

*Includes water, utility, and fire departments.

**Land Use Classifications: R - Residential
C - Commercial
I - Industrial
P - Public

NR - Not Reported

APPENDIX C

EQUIPMENT RENTAL AND OWNERSHIP GUIDELINES[62]

The American Public Works Association sets forth the following guidelines in determining whether to use employees cars, to lease or rent equipment, or to own them:

Employee Ownership

Use of employee cars is desirable when:

1. Mileage is low (opinions of what is low range from 5,000 to 10,000, or even 12,000, miles per year to justify government ownership; leasing is justified if use exceeds 18,000 miles).

2. Long idle periods are involved.

3. The government fleet would be too small to secure economies.

4. The government experiences difficulties in purchasing or leasing.

Rental or Lease Arrangements

It is usually desirable to rent or lease equipment when:

1. High-priced equipment that is infrequently used is required.

2. Special operating skill is necessary.

3. Employee-owned vehicles are used more than 18,000 miles per year.

4. The jurisdiction cannot provide adequate maintenance facilities and/or personnel.

5. An item is subject to rapid obsolescence.

6. The purchase cost is prohibitive or reimbursement for employee-owned vehicles would be more expensive.

7. It is necessary to have a guaranteed replacement available.

8. Peak loads or emergency demands must be met.

9. Maintenance costs are usually high.

Government Ownership

It is considered economical for a jurisdiction to own its equipment when:

1. In case of cars, the fleet is sizable -- 15 or more, depending on local needs.

2. Use of cars under employee reimbursement arrangements exceeds 10,000 to 12,000 miles per year (some place the mileage limit as low as 5,000)

3. The use of equipment is consistently high for individual items.

4. The jurisdiction has or can obtain proper facilities and personnel to maintain its equipment.

5. Good operators are available for heavy equipment.

6. Obsolescence is not likely to be rapid.

7. Parts are readily available.

8. There are not legal or fiscal obstacles to purchasing.

APPENDIX D

CENTRAL GARAGE STUDY

ST. LOUIS PARK, MINNESOTA[63]

GENERAL:

In this report, we have outlined the basic functions of our central garage. We have proposed specific functions which the facility should provide. On this basis, we can proceed to study, with the architect, the existing facilities and site as well as other possible sites for the new Central Garage.

BASIC FUNCTIONS:

It is proposed that the Central Garage will provide work areas and equipment for the following functions.

A. Inside Central Garage Building

1. Reception and time clock area
2. Central garage office
3. Personnel clean up area
4. Vehicle maintenance shop and service area
5. Vehicle wash rack
6. Heavy materials and equipment storage area
7. Parts and small tool stock room
8. Carpentry shop
9. Signs and signal maintenance shop
10. Engineering Department storage area
11. Park Department Recreation equipment storage
12. Vehicle and heavy equipment storage

    Street Department - (all)
    Park Department - (all)
    Water and Sewer Department - (part)
    Engineering Department - (all)
    Police Department - (all)
    Building Department - (all)

13. Park Department miscellaneous equipment storage

B. Outside Areas at Central Garage

14. Street maintenance materials storage
15. Snow plow storage
16. Water and sewer maintenance materials storage
17. Employee and visitor parking
18. Flat-bed trailer loading area
19. Outside truck scale

AREA NEEDS ESTIMATES BY FUNCTION

A. Garage Building Floor Space Needs (Not Including hallways, stairways, or vehicle aisles)	Square Feet
1. Reception and Time Clock Area	350
2. Central Garage Office (includes desks, files, etc.)	
Supt., Street Dept. - (separate office)	200
Foreman, Street Department	80
Foreman, Park Department	80
3. Personnel Clean Up Area	
Locker Room	700
Shower and lavatories	400
Lunch Room	950
4. Vehicle Maintenance Shop Service Area	
Vehicle repair area	3,000
Equipment service area (2 hoists and 1 lub. equipment)	1,000
5. Vehicle Wash Racks	450
6. Heavy Materials and Equipment Storage Area	
Tires - steel - cutting edges - shovels - picks - lubricants, etc.	2,000
7. Parts and Small Tool Stock Room	
Stock room	560
Stock room clerk	175
8. Carpentry Shop	750
9. Signs and Signals Maintenance Shop	1,000
10. Engineering Department Storage Area	
Materials storage	250
Materials testing	150
11. Park Department Recreation Equipment Storage	1,500

12. Vehicle and Heavy Equipment Storage

			Square Feet
Street Department			
Actual area - 1967	7,900		
Estm. actual area - 1975		8,700	
plus 75% clearance area (estimated average)		6,500	
		TOTAL FUTURE	15,200
Park Department			
Actual Area - 1967	1,900		
Estimated actual area - 1975		2,100	
plus 75% clearance area (estimated average)		1,600	
		TOTAL FUTURE	3,700
Water and Sewer Department			
Actual area - 1967	340		
Estm. actual area - 1975		400	
plus 75% clearance area		300	
		TOTAL FUTURE	700
Engineering Department			
Actual area - 1967	400		
Estm. actual area - 1975		450	
plus 75% clearance area		340	
		TOTAL FUTURE	790
Police Department			
Req'd. storage - actual - 1967 (8 cars)	960		
Estm. required - 1975 (10 cars) plus 75% clearance area		1,200 900	
		TOTAL FUTURE	2,100
Building Department			
Req'd. storage - 1967 (4 cars)	420		
Estm. required - 1975 (5 cars)		540	
plus 75% clearance		400	
		TOTAL FUTURE	940

13. Park Department Miscellaneous Playground and Park Equipment

Misc. park equipment storage			3,000
		TOTAL	40,025 sq.ft.

B. Outside Storage and Parking Space Needs
(Not including roadways and loading areas except for parking estimate which includes aisle area)

14. Maintenance Materials - Street Department	Square Feet
Gravel (1800 c.y.) - Sand (900 c.y.)	3,500
Crushed Rock - (400 c.y.)	1,000
Salt (special enclosed structure (500 tons)	1,060
Bituminous winter mix (300 c.y.)	800
Asphalt materials (2 - 12,000 gal.tanks 9' x 25')	2,500
Gasoline storage and pumps	1,000

15. Snow Plows - Street Department - Park Department - Water and Sewer Department	
Street Dept. - 8 one way truck plow	1,600
3 V-plows for blades (nested)	220
2 V-plows (truck and Michigan)	160
3 blade snow wings	220
1 snow bucket (Michigan)	40
2 V-Plows (Jeep and Bobcat)	60
1 Snow Bucket (Bobcat)	15
Park Dep't. - 1 one-way truck plow	200
Water and Sewer Dept. 1 one-way truck plow	200

16. Maintenance Materials - Water and Sewer Department 18,000

17. Employee and Visitor Parking (includes aisles)

	Permanent Employees	Temporary Employees
Street Department	23	5
Engineering Department	7	3
Park Department	11	8
Sub-Total	41	16
Visitor parking 4		
TOTAL	61 Vehicles	

Parking dimensions for estimate
90° - angle of parking
9' - stall width
18' - stall depth
23' - aisle width
184.5 sq. ft. per vehicle for opposite parking

Parking Area for above 18,000

		Square Feet
18.	Flat-Bed Trailer Loading Area	600
19.	Outside Truck Scale	250
	TOTAL	49,525 sq.ft.

Conclusion

The proposed area requirements do not include hallway, stairways, or vehicle aisle areas which can only be determined after the building plans are prepared. The same holds true for outside storage areas except for parking where we have included the aisle area.

We have anticipated that approximately 60 people will be using the facility.

The Central Garage is proposed to be the headquarters for the Street Department and Park Department, with vehicle storage for Police, Engineering, and Building Departments, with a limited amount of Water and Sewer Department vehicle storage.

The inside and outside storage areas at the Central Garage will include all the materials for Street, Water and Sewer, and Park Departments.

We suggest that the Departments other than those in the Division of Public Works be requested to review the proposals in this report for their recommendations.

We would also suggest that the mechanical design in a building of this type warrants special consideration, and that the designers should be chosen from qualified engineering firms. Heating and ventilating warrant careful study, particularly in the shop areas.

EQUIPMENT SPACE REQUIREMENTS

Street Department

Vehicle No.	Description	Length	Width	Height	Area S.F.
501	Wayne Sweeper	18.0'	9.2'	9.8'	165.6
502	Elgin Sweeper	17.0'	9.3'	9.8'	158.1
503	Huber Steel Roller	14.0'	5.5'	7.0'	77.
504	Buckeye Spreader	11.2'	6.8'	3.5'	76.16
505	Int. Tractor with Bucket	11.6'	8.6'	8.0'	99.76
506	Pneu. Tire Roller (Bros)	13.0'	6.0'	8.4'	78.
507	Int. Super A Tractor and Mower	10.3'	5.6'	8.4'	57.68
508	Toro Sander	5.0'	4.0'	3.0'	20.
509	Roll Pac Roller	5.3'	4.1'	4.4'	21.73
510	Shop Made Trailer	10.0'	6.2'	3.0'	62.
511	Int. Tractor w/Broom	14.3'	7.5'	6.8'	107.25
512	Electro-Majic Steam Cleaner	5.0'	2.2'	3.2'	11.
513	Weston Hopper Sander on No. 531	See 531			
514	Ford Tractor w/Sickle Mower	10.4'	8.5'	8.6'	88.4
515	Wanner Weed Sprayer	9.4'	5.5'	6.9'	51.7
516	Gorman Rupp Pump (At water Dept.)	12.0'	5.5'	6.2'	66.
517	Gorman Rupp Pump (At water Dept.)	12.8'	6.4'	6.2'	81.92
518	Seaman Tiller Mixer	16.7'	6.6'	6.6'	110.22
519	Hough Loader 65C	20.5'	8.3'	11.1'	170.15
520	Adams Travel Loader	31.0'	8.8'	10.7'	272.8

Vehicle No.	Description	Length	Width	Height	Area S.F.
521	Tar Kettle on Trailer	12.0'	5.7'	8.0'	68.40
522	Allis Chalmers Motor Grader	27.5'	9.5'	11.7'	261.25
523	Cat. Motor Grader	27.2'	10.6'	11.6'	288.32
524	Wabco Motor Grader	29.0'	9.5'	11.9'	275.5
525 525D	Chev. Truck Oil Distributor	23.3'	8.5'	9.0'	198.
526 526S 526P	Chev. Dump Truck with Plow and Tail Gate Spreader	27.4'	8.5'	9.0'	232.9
527 527S 527P	Chevrolet Dump truck with Plow and Tail Gate Spreader	27.0'	0.3'	8.6'	251.
529	Rosco Street Flusher	11.5'	7.9'	7.3'	90.85
530 530P	Ford F-800	18.5'	8.0'	8.2'	148.
531	Ford F-8 Chassis Truck W/513	21.0'	8.0'	8.3'	168.
533 533A	Michigan Loader-85A Snow Bucket	17.0'	7.1'	9.7'	120.7
533P	Good Roads V-Plow	8.0'	10.5'	4.8'	84.
534	Ford F-8 Truck w/538	20.8'	8.0'	8.6'	166.4
535 535P	Ford F-8 W/Plow	26.8'	9.0'	8.6'	241.2
536 536P	Chevrolet Dump Truck W/Plow	25.0'	9.5'	9.0'	237.5
537 537P	Chevrolet Dump Truck W/Plow	26.0'	9.4'	8.3'	244.4
538	Tarrant Sand Spreader on 534	---	---	---	---
539	Jay Tamper	3.5'	1.5'	3.4'	5.25

Vehicle No.	Description	Length	Width	Height	Area S.F.
540 540P	4 W Dr. Jeep W/Plow	14.8'	5.8'	6.5'	85.84
541 541A	Chevrolet Truck W/Aerial Tower	27.0'	9.4'	12.0'	253.8
542 542P	Chevrolet Dump W/Plow	26.0'	9.4'	8.3'	244.4
543 543A	Ford Dump W/Lo-Dal	22.3'	9.0'	8.2'	200.7
544 544P	Chevrolet Dump W/Plow	26.7'	9.5'	8.2'	253.65
545 545P	Chevrolet Dump W/Plow	26.3'	9.0'	8.2'	236.7
551	Sickle or Mower	5.2'	3.0'	3.1'	15.6
552	Trailer	7.4'	6.0'	4.4'	51.8
562	Ford 3/4 Ton	17.4'	7.0'	7.2'	121.8
-	Sign Shop Paint Sprayer and Trailer	6.0'	4.2'	3.5'	25.2
570	Stump Remover (Tree Maintenance)	13.8'	8.8'	7.0'	121.4
564	Ford Pickup (Sign Shop)	16.8'	8.0'	7.3'	134.4
565	Ford 4 Door Sedan	17.5'	6.7'	5.0'	117.25
	Ford 1/2 Ton Pickup	15.5'	6.8'	6.5'	105.4
580	Double Drum Sheep Steel Roller	12.6'	10.0'	4.3'	126.
581	Low Boy Trailer	27.3'	8.5'	4.7'	232.
581A	Low Boy Trailer	26.1'	8.0'	4.5'	208.8
582P	Trio Rotary Snow Plow	7.0'	7.0'	8.5'	49.
583	Gorman Rupp Pump	2.0'	1.2'	1.5'	2.4
584	Rex Pump (Portable)	3.9'	2.3'	3.1'	4.0

Vehicle No.	Description	Length	Width	Height	Area S.F.
585	Gorman Rupp Pump	2.0'	1.2'	1.5'	2.4
587	Nashua Mobile Office	26.5'	8.1'	9.0'	214.65
590	Artic Snow Caster	4.4'	2.4'	3.2'	10.56
569	Chipper (Tree Maintenance)	13.6'	6.0'	7.9'	81.6
589	Rotomist (Tree Maintenance)	13.7'	7.7'	8.8'	105.49
			SUB-TOTAL		7,871.98

PARK DEPARTMENT

-	New Ford Tractor W/Bucket and Rear Snow Blower	22.2'	6.5'	7.0'	144.3
680	M/M Track and Sweeper	18.4'	7.7'	7.7'	141.68
685	Ford Dump and Plow	25.5'	8.7'	7.6'	221.85
684	Vanette	20.3'	8.0'	9.4'	162.4
678	Pickup	18.0'	8.0'	7.0'	144.
679	Pickup	16.0'	8.0'	7.0'	128.
617	Pickup	18.0'	8.0'	7.0'	144.
610	Pickup	18.0'	8.0'	7.0'	144.
683	Pickup	18.0'	8.0'	7.0'	144.
1 only	Toro	16.0'	8'2"	5.0'	131.2
5 only	Gravley	7.0'	3.0'	3.5'	21 105.T
5 only	Mower	5.0'	2.5'	3.5'	12.5 62.5T
2 only	Tractor	10.0' 20.0'	5.5' 7.0'	5.0' 7.0'	55. 140.
4 only	Sulky	4.0'	3.0'	3.0'	12. 48.T
1 only	Trimmer	4.0'	1.0'	3.0'	4.
				SUB-TOTAL	1,919.93

Vehicle No.	Description	Length	Width	Height	Area S.F.
Water and Sewer Department					
367	Bucyrus Erie Crane Carrier	42.0'	9.2'	12.0'	286.4
367A	Backhoe - Drag Bucket	25.0'	2.0'	5.0'	50.
			SUB-TOTAL		336.4
Engineering Department					
450	Rambler				
451	Econoline	14.0'	6.6'	8.0'	92.4
452	Econoline	14.0'	6.6'	8.0'	92.4
453	Econoline	14.0'	6.6'	8.0'	92.4
454	Plymouth Belvedere	17.5'	6.7'	5.0'	117.25
			SUB-TOTAL		394.45
Police Cars					
770	(Automobiles)	6.8'	18.'	5.10'	122.4
771		6.8	18.'	5.10'	122.4
772		7.8'	18.'	6.6'	118.8
773		7.8'	18.'	6.6'	118.8
774		7.8'	18.'	6.0'	118.8
775		6.7'	17.9'	4.10'	119.9
776		6.0'	15.10'	4.10'	90.6
777		6.8'	17.9'	4.10'	121.7
778		6.7'	18.'	5.9'	120.6
779		6.8'	14.2'	8.0'	96.56
780		6.8'	18.2'	6.0'	123.76

Vehicle No.	Description	Length	Width	Height	Area S.F.
781		6.8'	18.2'	6.0'	123.76
	Motorcycle	3.8'	7.9'	5.0'	30.02
			SUB-TOTAL		1,428.10
Building Department					
283	(Automobiles)	6.6'	18.0'	4.9'	118.8
282		6.6'	17.2'	4.9'	113.5
280		6.0'	15.10'	4.9'	90.60
281		6.0'	15.10'	4.9'	90.60
			SUB-TOTAL		413.50
			GRAND TOTAL		12,364.36

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